

Translation

PATENT COOPERATION TREATY

PCT/EP2003/006090



PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Applicant's or agent's file reference A 14489-PCT | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/EP2003/006090 | International filing date (day/month/year) 11 June 2003 (11.06.2003) | Priority date (day/month/year) 22 June 2002 (22.06.2002) |
| International Patent Classification (IPC) or national classification and IPC G03G 15/16 | | |
| Applicant SCHOTT AG | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
 This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
These annexes consist of a total of 5 sheets.
3. This report contains indications relating to the following items:
 - I Basis of the report
 - II Priority
 - III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV Lack of unity of invention
 - V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI Certain documents cited
 - VII Certain defects in the international application
 - VIII Certain observations on the international application

| | |
|-------------------------------------------------------------------|------------------------------------------------------------------|
| Date of submission of the demand 02 December 2003 (02.12.2003) | Date of completion of this report 04 August 2004 (04.08.2004) |
| Name and mailing address of the IPEA/EP | Authorized officer |
| Facsimile No. | Telephone No. |

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International application No.

PCT/EP2003/006090

I. Basis of the report

1. With regard to the elements of the international application:*

 the international application as originally filed the description:

pages _____ 1-10 _____, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____

 the claims:

pages _____, as originally filed

pages _____, as amended (together with any statement under Article 19)

pages _____, filed with the demand

pages 1-18 _____, filed with the letter of 23 June 2004 (23.06.2004)

 the drawings:

pages 1/2-2/2 _____, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____

 the sequence listing part of the description:

pages _____, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language _____ which is:

 the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

 contained in the international application in written form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4. The amendments have resulted in the cancellation of: the description, pages _____ the claims, Nos. _____ the drawings, sheets/fig _____5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|------|-----|
| Novelty (N) | Claims | 1-18 | YES |
| | Claims | | NO |
| Inventive step (IS) | Claims | 1-18 | YES |
| | Claims | | NO |
| Industrial applicability (IA) | Claims | 1-18 | YES |
| | Claims | | NO |

2. Citations and explanations

1. Reference is made to the following documents:

D1: EP-A-0 769 728 (HEWLETT PACKARD CO) 23 April 1997 (1997-04-23)

D2: WO 92/22018 A (KAO CORP) 10 December 1992 (1992-12-10)

2. Document D1, which is considered the prior art closest to the subject matter of claim 1, discloses (the references in parentheses relate to said document) :

- a printing device with an electrophotographic printing unit associated with a transfer medium (24) for transferring a toner powder to a substrate in a transfer zone, it being possible to guide the substrate through the transfer zone using a transport system and to introduce thermal energy into the substrate by one or more heating elements (30, 34), the transfer medium (24) being associated with a cooling unit (36) which draws off this thermal energy.

The subject matter of claim 1 differs therefore from the known printing device in that [the printing

device is designed such that, when in use], in the transfer zone formed with the substrate, the temperature of the transfer medium (24) at least in the region of the contact surface is lower than the surface of the substrate.

In D1, the surfaces of both the transfer medium and the substrate are heated.

The subject matter of claim 1 is therefore novel (PCT Article 33(2)).

3. The problem addressed by the present invention can therefore be considered that of improving the transfer of toner from the transfer medium to the substrate, in particular when printing thick substrates such as, for example, panes of glass.

The solution to this problem proposed in claim 1 of the present application involves an inventive step for the following reasons (PCT Article 33(3)):

None of the citations discloses the solution in which a temperature gradient is brought about specifically in the transition region of the transfer zone. This temperature gradient assists the release of the toner, which leads to increased transfer rates in particular with thick substrates such as glass.

Known measures for improving the transfer rate (see, for example, D3, D4) point in the opposite direction, namely the transfer from a surface having a high temperature to a surface having a low temperature.

The proposed solution, which was obtained

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empirically, is therefore neither known nor obvious from the prior art.

The subject matter of claim 1 therefore meets the requirements of PCT Article 33(3).

4. Claims 2-18 are dependent on claim 1 and therefore likewise meet the PCT novelty and inventive step requirements.

Claims

1. A printing device with an electro-photographic print unit (30), to which a transfer medium (34) for transferring a toner powder to a substrate (13) in a transfer zone is assigned, wherein the substrate (13) can be conducted through the transfer zone by means of a transport system (10), wherein heat energy can be introduced into the substrate (13) by means of one or several heating elements (24),

characterized in that

a cooling device (35) is assigned to the transfer medium (34), which removes heat from the latter.

2. The printing device in accordance with claim 1,

characterized in that

at the transfer zone formed with the substrate (13), the transfer medium (34) has a lower temperature, at least in the area of the contact face, than the surface of the substrate (13).

3. The printing device in accordance with claim 1 or 2,

characterized in that

the cooling device (35) cools the temperature of the transfer medium (34) to a temperature $\leq 60^{\circ}\text{C}$.

4. The printing device in accordance with one of claims 1 to 3, characterized in that the cooling device (35) cools the temperature of the transfer medium (34) to a temperature $\leq 40^{\circ}\text{C}$.

5. The printing device in accordance with one of claims 1 to 4, characterized in that the toner transfer in the transfer zone can be affected by means of one or several coronas (12).

6. The printing device in accordance with one of claims 1 to 5, characterized in that the substrate (13) is placed on an electrically conductive base, and in respect to the charge of the toner, the base is charged with the reverse polarity sign.

7. The printing device in accordance with one of claims 1 to 6, characterized in that the substrate (13) is moved past the transfer medium (34) synchronously in respect to the circumferential speed of the transfer medium (34) by means of a transport system (10), and

a charge with the opposite polarity sign of the charge of the toner is applied to the transfer medium (34) in the transport system (10).

8. The printing device in accordance with one of claims 1 to 7, characterized in that on its surface which receives the toner powder, the transfer medium (34) is provided with an anti-adhesive layer (34.3), and this anti-adhesive layer (34.3) has a surface energy within the range of 15 mN/m to 30 mN/m.

9. The printing device in accordance with one of claims 1 to 8, characterized in that the substrate (13) can be charged with heat energy by means of one or several a heating elements designed as infrared radiators and/or hot air blowers and/or by means of the application of a flame.

10. The printing device in accordance with one of claims 1 to 9, characterized in that the substrates (13) to be imprinted are heated to the required temperature in an upstream-located temperature process, for example in a continuous throughput oven with ambient air heaters.

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11. The printing device in accordance with one of claims 1 to 10, characterized in that the heating element (24) heats the surface of the substrate (13) to a surface temperature range between 80°C and 200°C, at least in certain areas.
12. The printing device in accordance with claim 11, characterized in that the surface temperature of the substrate (13) is 100°C to 170°C, at least in certain areas.
13. The printing device in accordance with one of claims 1 to 10, characterized in that a temperature sensor (21) is assigned to the substrate (13), and the heating element (24) and/or the transport system (10) can be controlled by means of a control device (23) as a function of the signal emitted by the temperature sensor (21).

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14. The printing device in accordance with one of claims 1 to 13, characterized in that several temperature sensors (21) are arranged over the entire print width, and a heating element (24) is assigned to each of the temperature sensors (21), and the heating output can be separately controlled within zones over the print width.

15. The printing device in accordance with claim 14, characterized in that the temperature sensor (21) is a pyrometer.

16. The printing device in accordance with one of claims 1 to 15, characterized in that one or several liquid-cooled contact rollers of the cooling device (35) roll off on the transfer medium (34), and/or a climate-controlled air flow is directed onto the surface of the transfer medium.

17. The printing device in accordance with one of claims 1 to 16, characterized in that the transfer medium (34) is embodied as a transfer roller or a transfer belt, which contains at least a portion of the cooling device (34).

18. The printing device in accordance with claim 17,
characterized in that
the transform medium (34) embodied as a transfer roller has interior air
cooling.

19. The printing device in accordance with one of claims 1 to 18,
characterized in that
the cooling device (35) removes heat energy from the transfer medium (34)
downstream of the transfer zone and upstream of the photoconductor (32) of the print unit
(30) in the transport direction of the transfer medium (34).

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